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Wanha

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[54] **UNIVERSAL CONTACT INSERTION TOOLING**

[75] Inventor: **Christopher Donald Wanha**, Costa Mesa, Calif.

[73] Assignee: **ITT Manufacturing Enterprises, Inc.**, Wilmington, Del.

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[51] **Int. Cl.**[7] **B23P 19/00**

[52] **U.S. Cl.** **29/747**; 29/758; 29/760; 29/876

[58] **Field of Search** 29/747, 758, 760, 29/876

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Primary Examiner—Lee Young
Assistant Examiner—Kevin G. Vereene
Attorney, Agent, or Firm—Thomas L. Peterson

[57] **ABSTRACT**

Tooling is provided for inserting electrical contacts into holes **(20)** of a connector insulator **(90)**, which enables easy setup for different connectors. The tooling includes a lower tool **(12)** for supporting a connector housing **(14)** and an upper tool **(16)** which is vertically slidable toward the lower one and which carriers insertion pins **(30, 32)** for pushing contacts into the insulator. The upper tool includes a block **(22)** having three long rows of pin passages **(24)** and a backup device **(50)** which lies over insertion pins lying in the passages to push them down. Insertion pins of a desired type (for inserting pin or socket contacts) can be inserted into selected passages corresponding to the particular connector into which contacts are to be inserted.

13 Claims, 6 Drawing Sheets

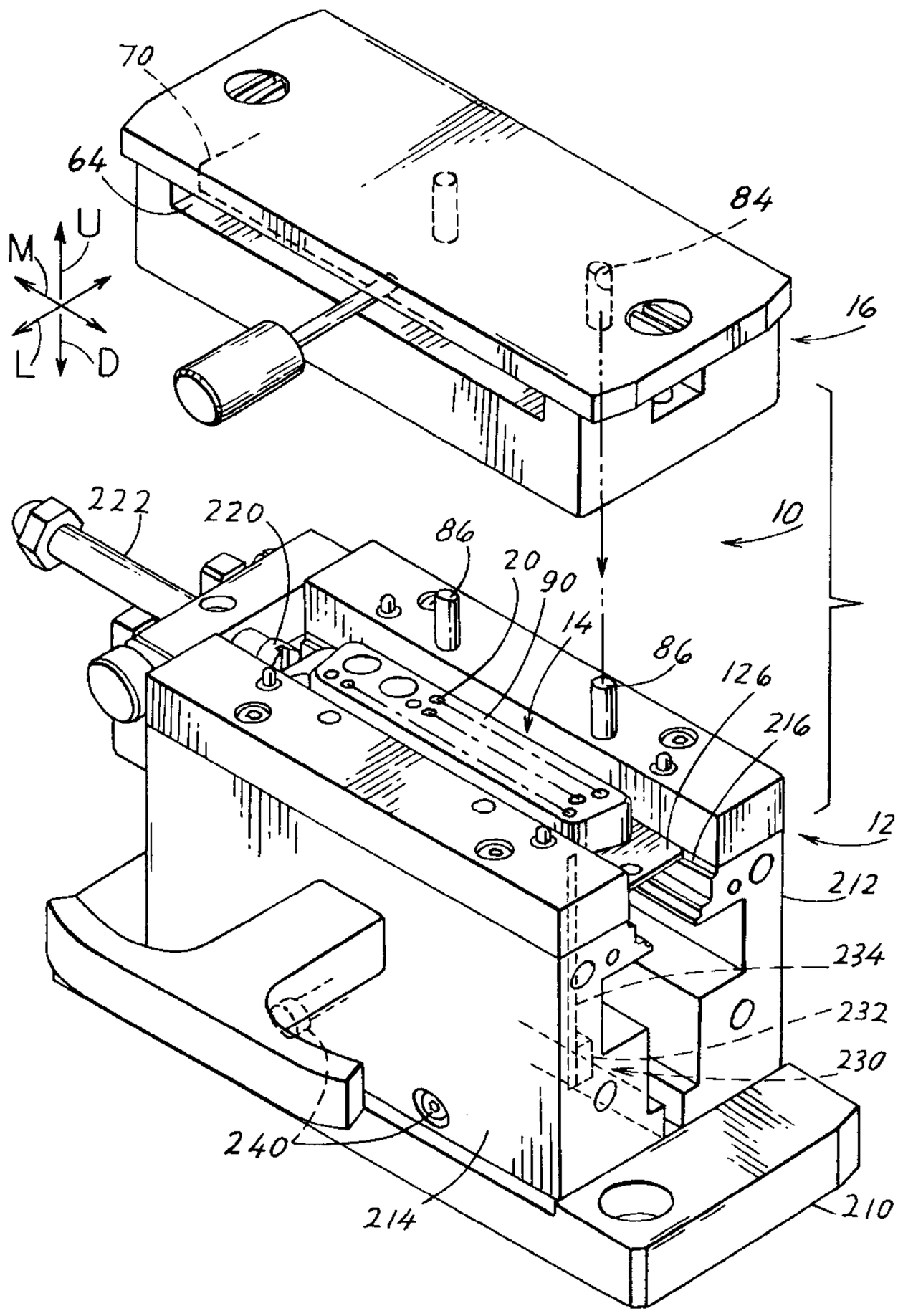
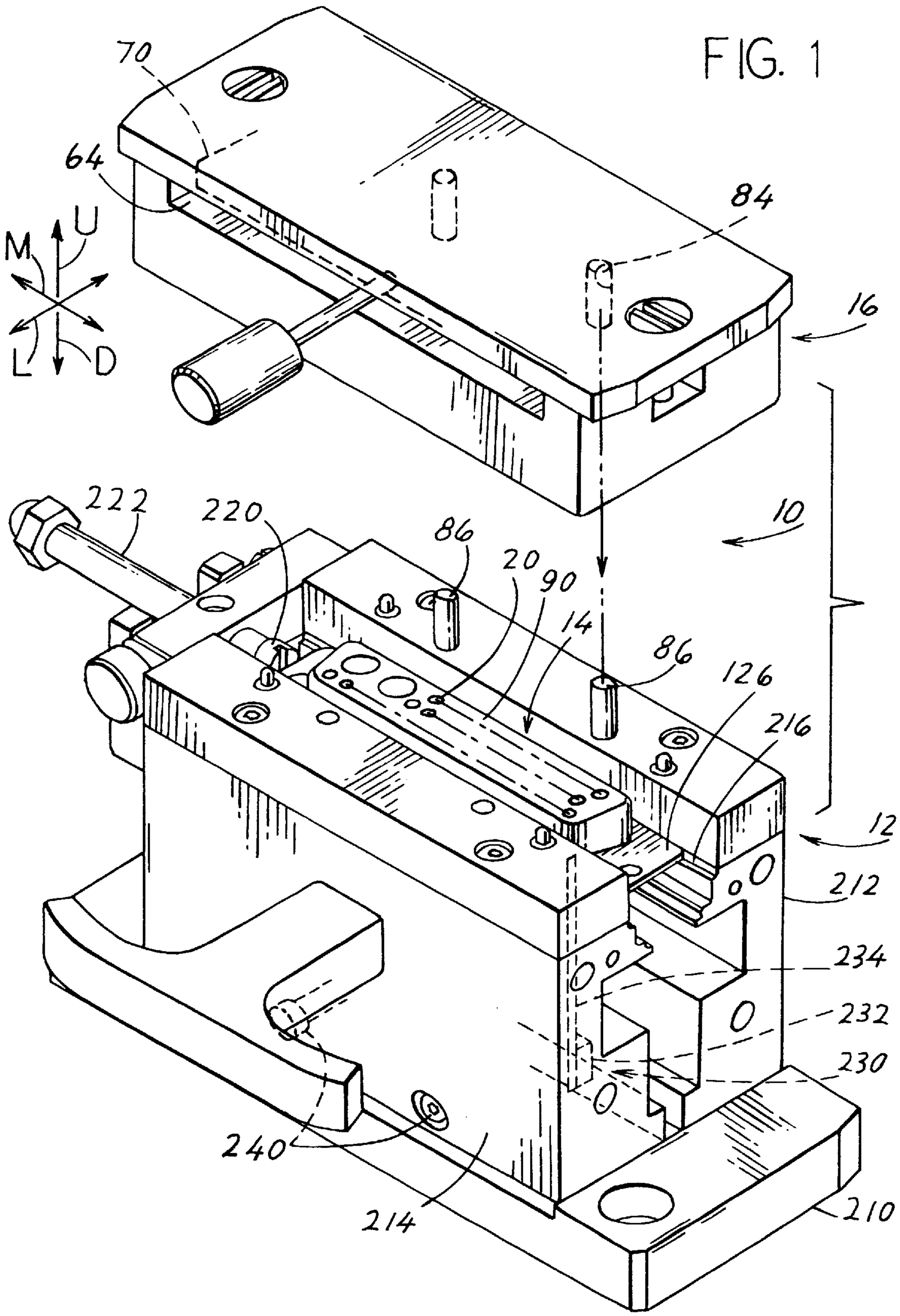


FIG. 1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M
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240
214
210

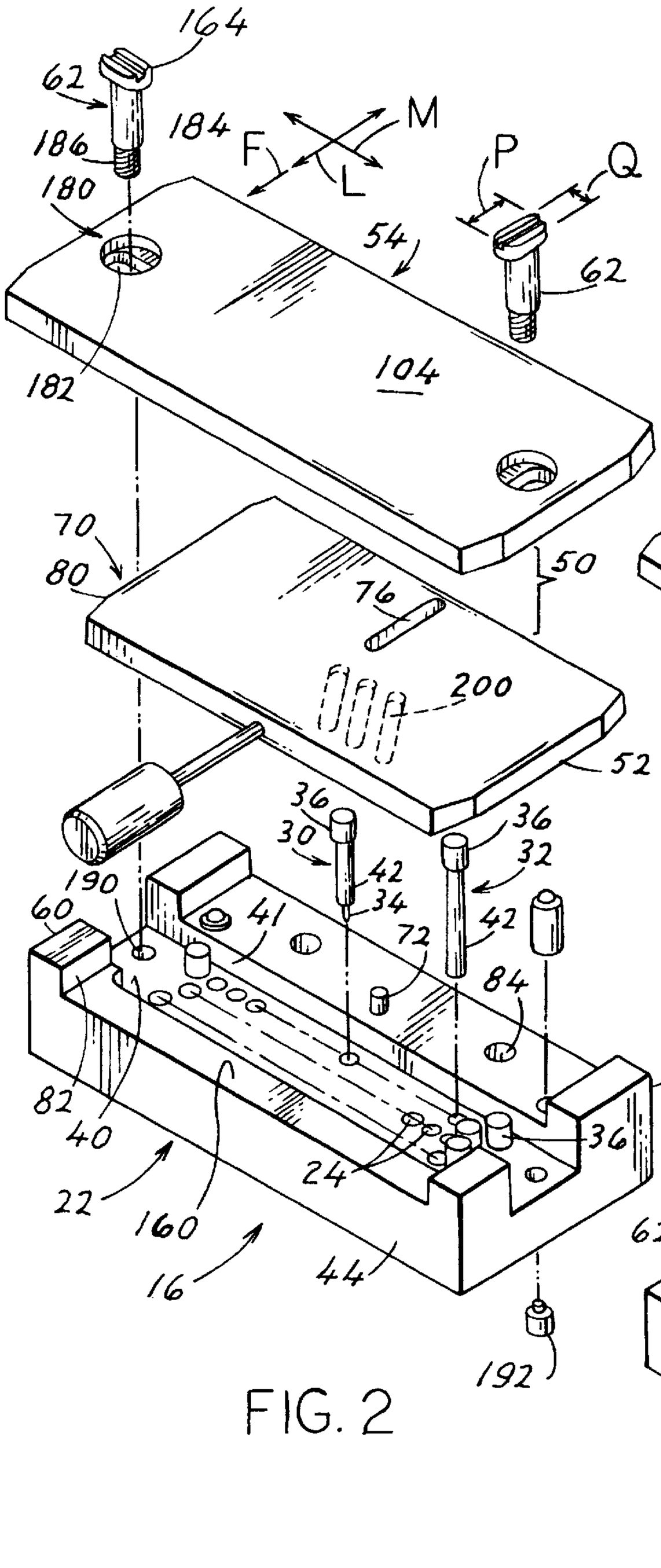

164
62
186
184
180
182
104
F
M
L
P
Q
54
62
70
80
76
50
200
52
36
30
42
34
36
32
42
72
84
190
60
41
82
40
22
160
16
44
36
24
60
192

FIG. 2

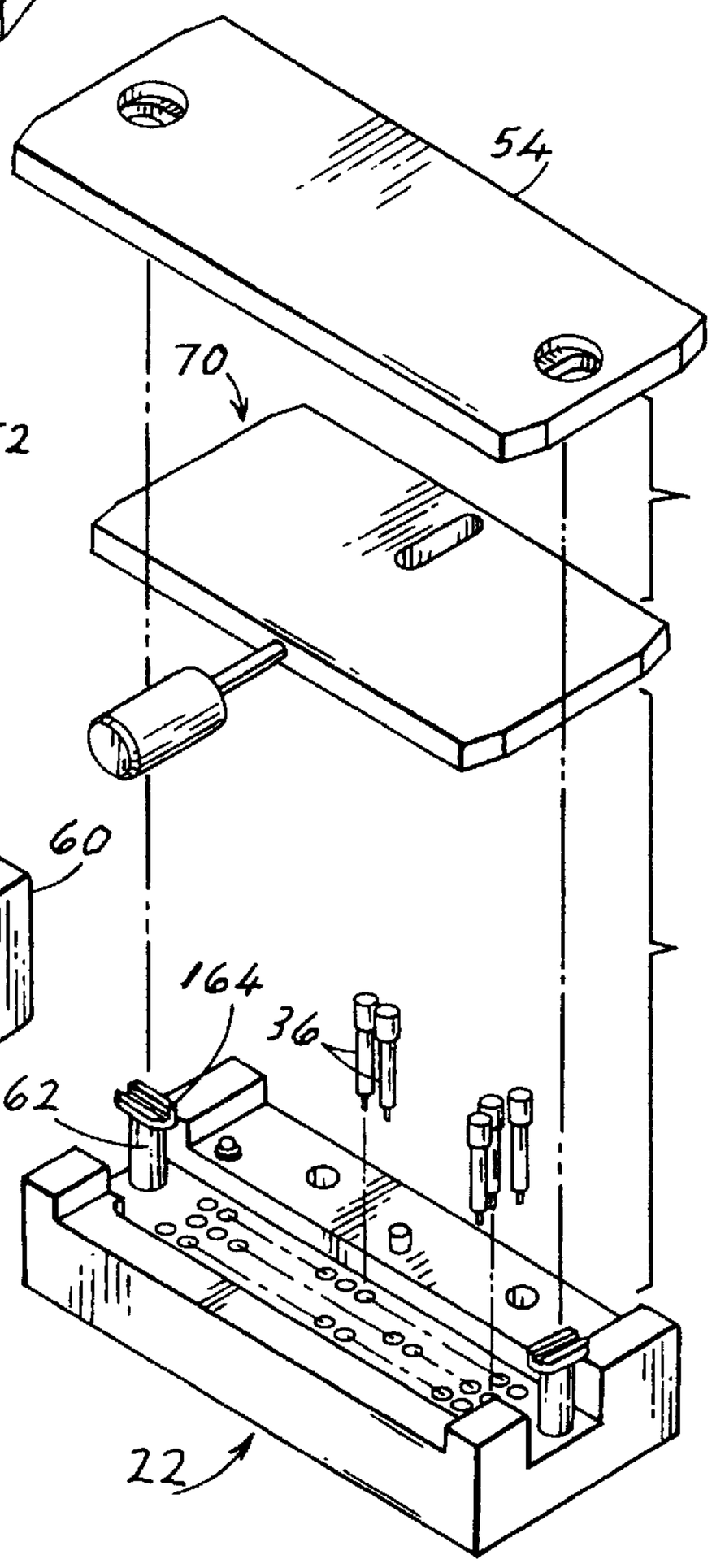

54
70
164
36
62
22

FIG. 3

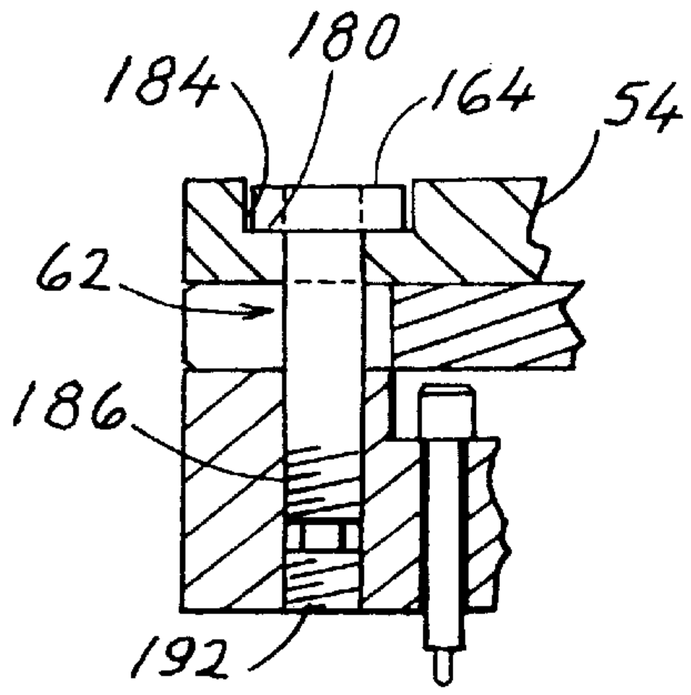

180
184
164
54
62
186
192

FIG. 5

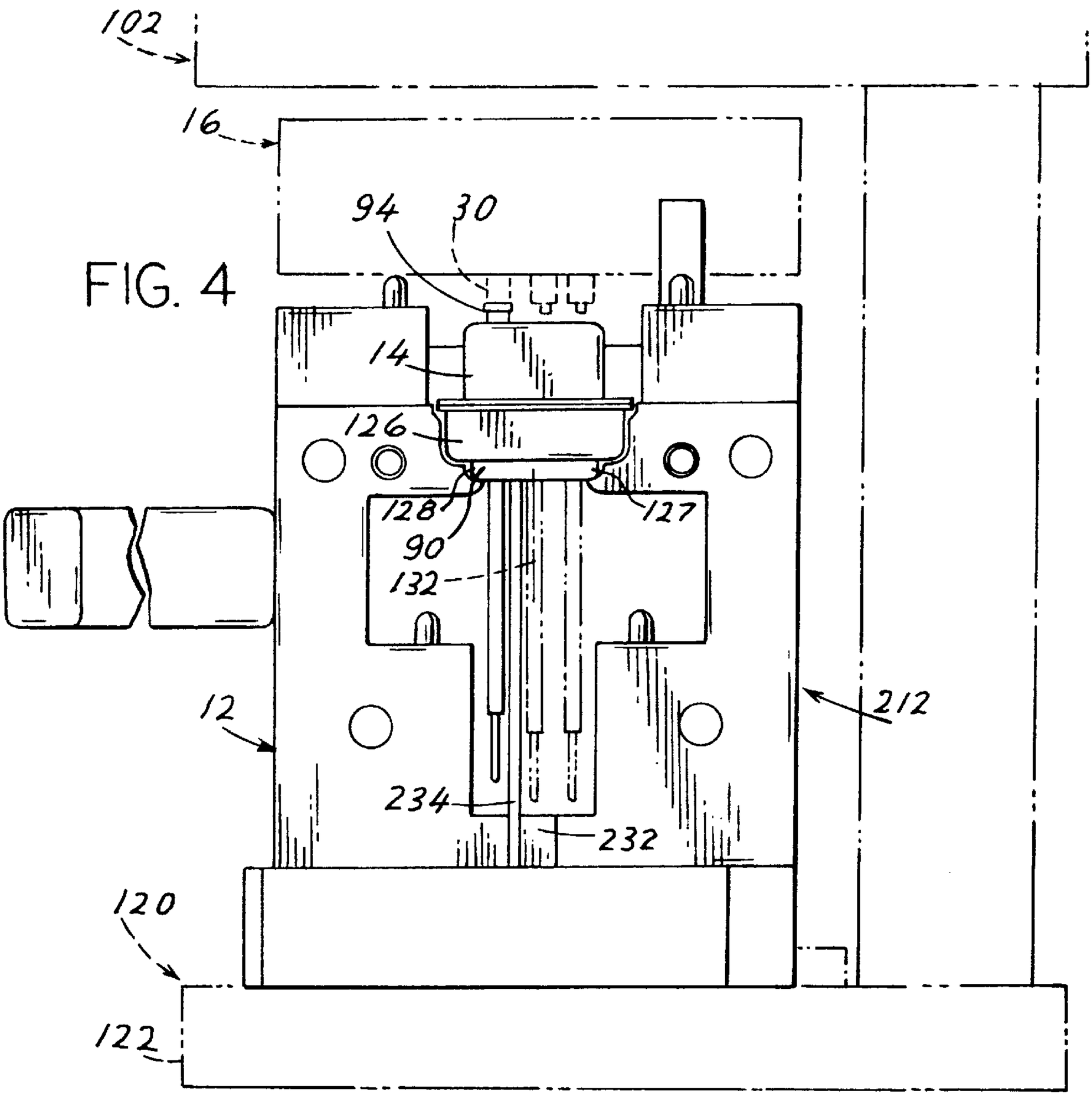

102
16
94
30
14
126
128
90
132
127
12
212
234
232
120
122

FIG. 4

FIG. 6A FIG. 6B FIG. 6C

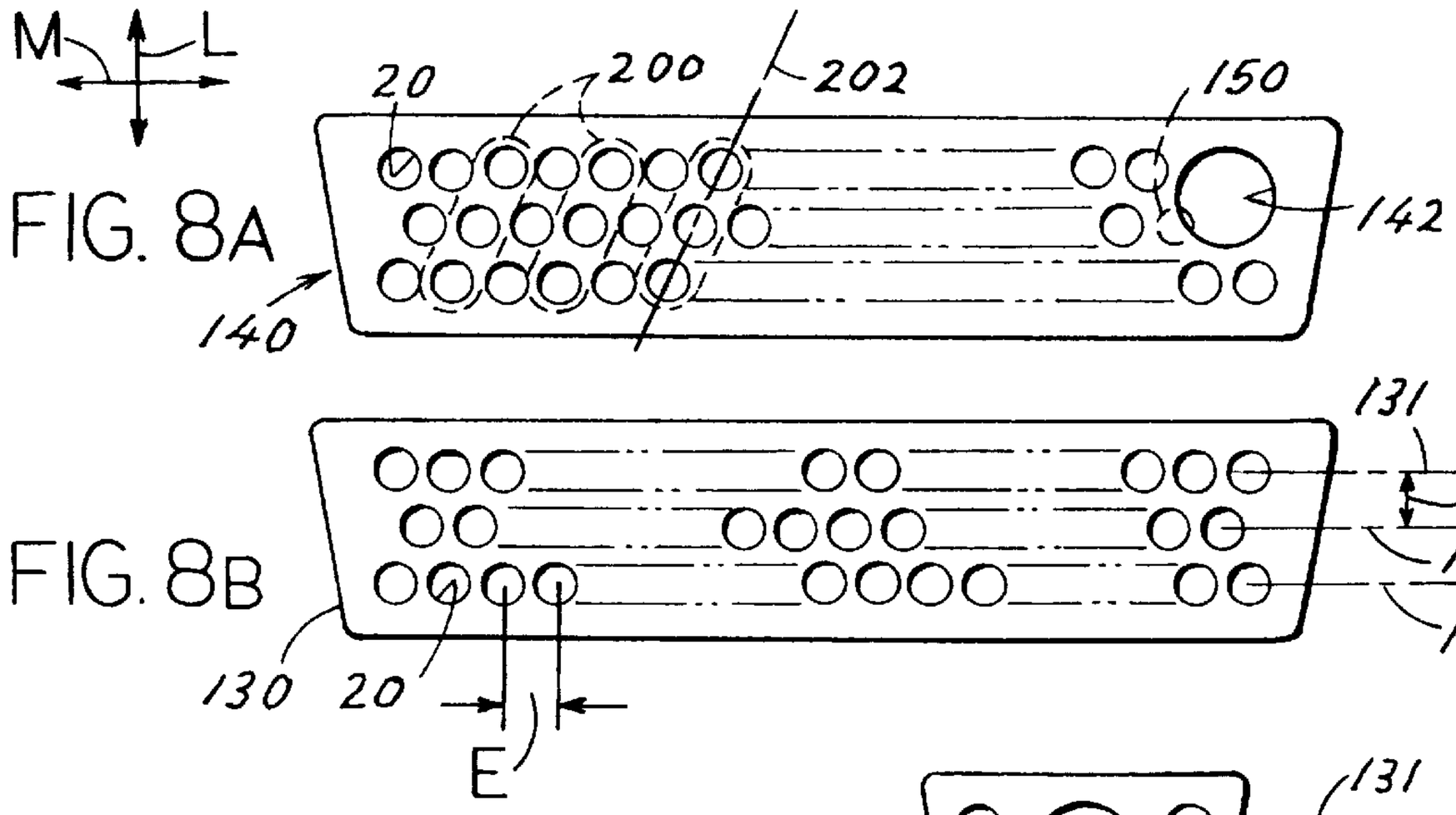


FIG. 8A

FIG. 8B

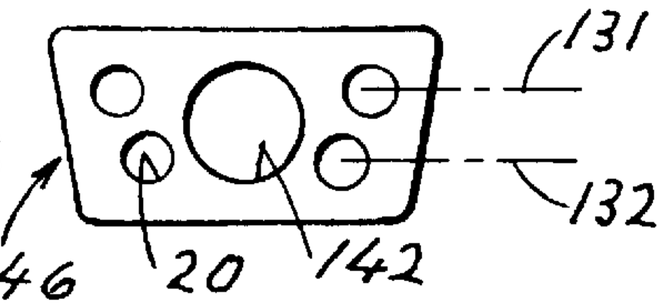


FIG. 8C

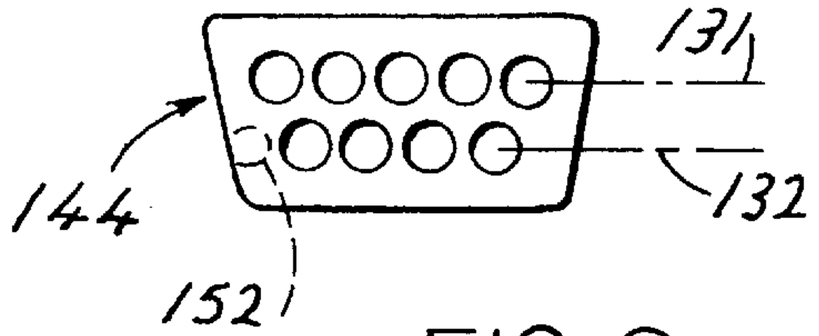


FIG. 8D

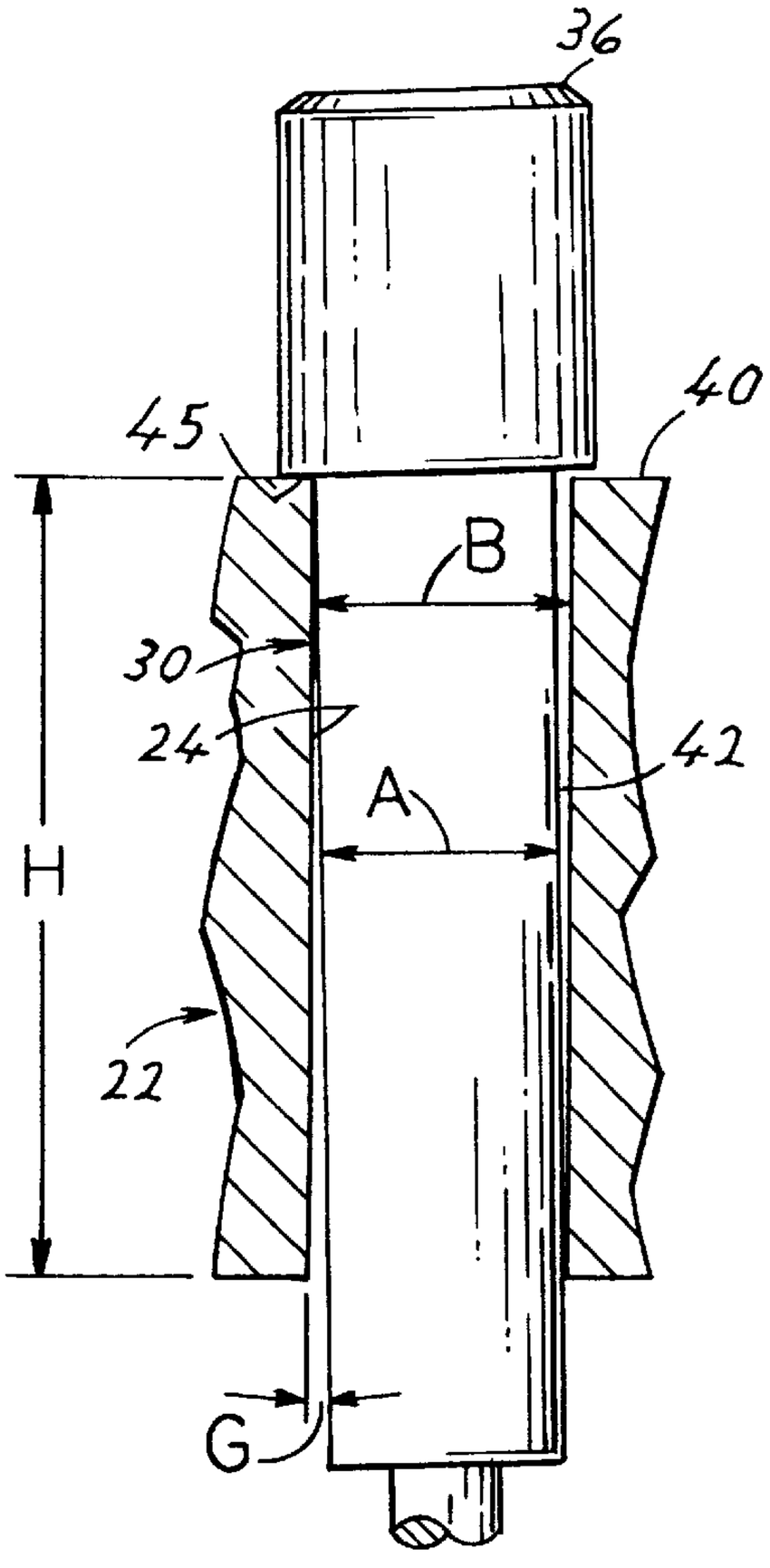
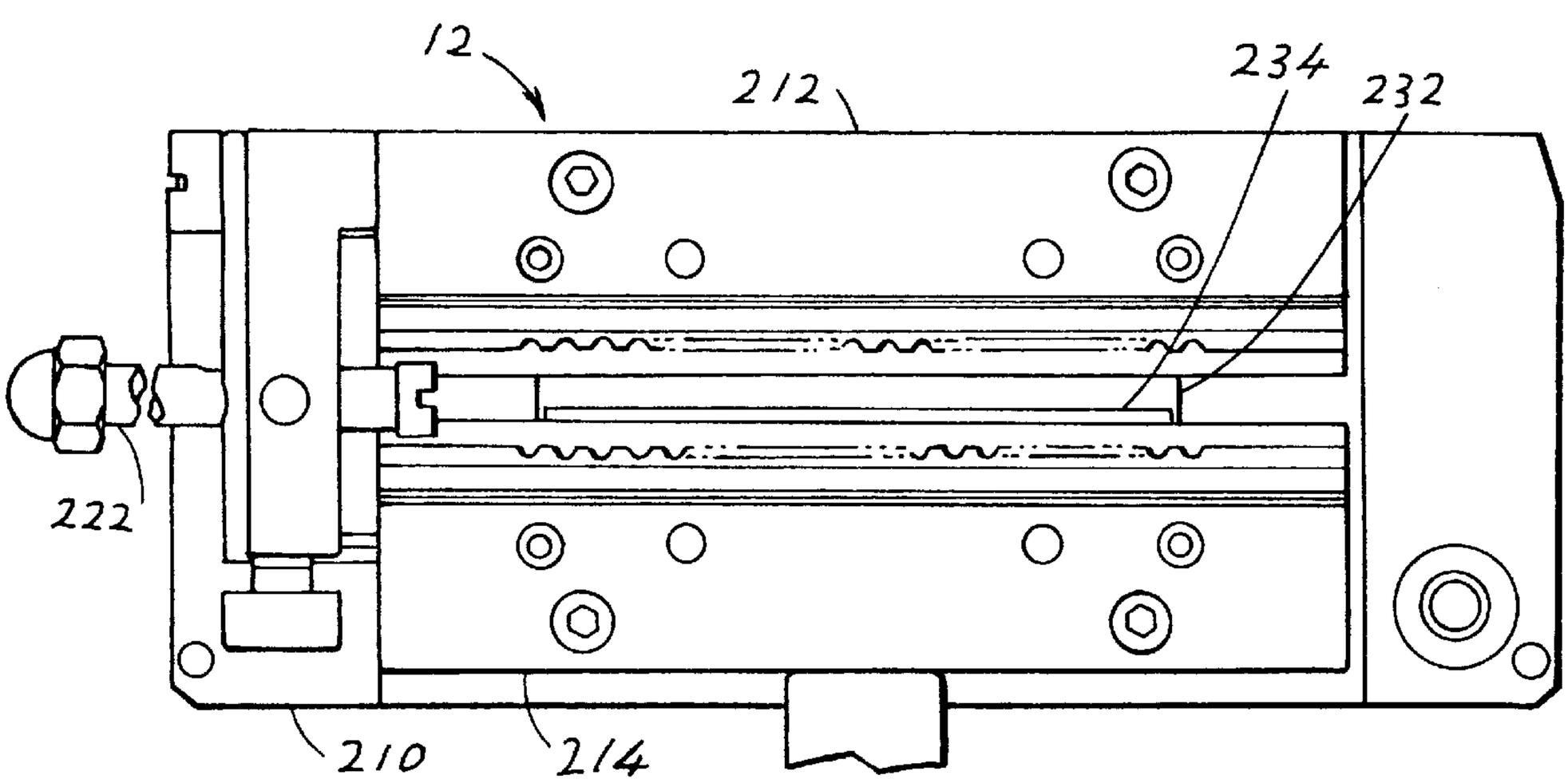


FIG. 7

FIG. 9



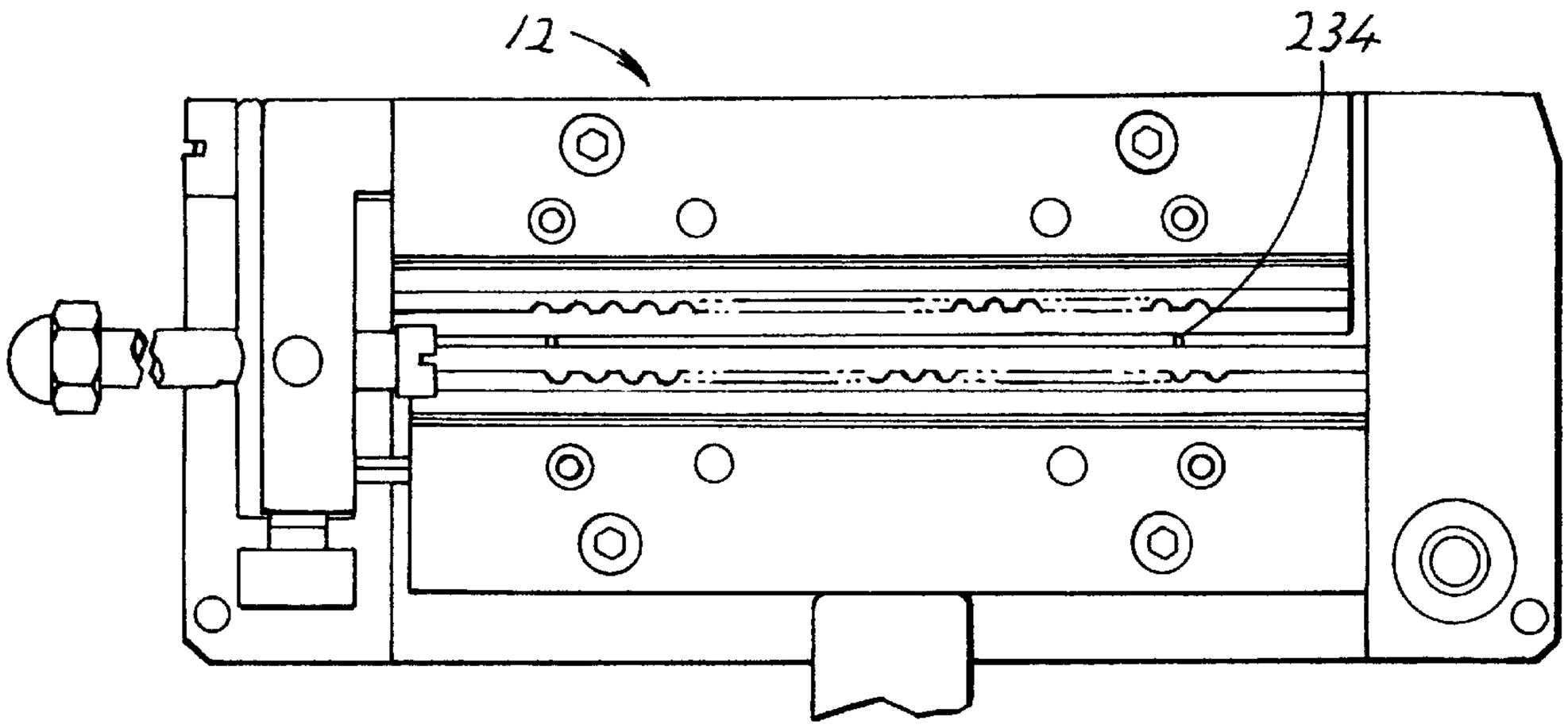


FIG. 10

UNIVERSAL CONTACT INSERTION TOOLING

BACKGROUND OF THE INVENTION

Machined electrical contacts are commonly installed in holes of a connector insulator by forcefully pressing the contacts into the holes, with an interference fit of barbs retaining the contacts. Two basic approaches are used to insert and seat the contacts, one being single contact insertion, or stitching, and the other being multiple contact insertion, or gang loading. In machine stitching, one contact at a time is inserted, which requires either an expensive machine setup or time consuming hand insertion of one contact at a time. In gang loading, many or all contacts are inserted at one time. Gang loading has required tooling with one or more rows of accurately positioned projections. Most connectors have two or three rows of contacts, but the number and positions of the contacts varies. It is costly to manufacture tooling for each of the numerous connectors, and inconvenient to store all of the tooling. Tooling that enabled the insertion of contacts in a variety of connectors, would be of value.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, contact insertion tooling is provided, which enables rapid changeover to insert contacts in a variety of connectors. The tooling includes a lower tool for supporting a connector housing that includes an insulator with holes, and an upper tool which is vertically slidable toward the lower one. The upper tool includes a block having horizontal rows of vertical passages, insertion pins that can be installed in selected passages, and a backup device which lies over the insertion pins and which can push them down when the upper tool is pushed down in a press.

Each of the insertion pins lies loosely in a corresponding passage and the passages are tall enough, that each insertion pin lies within a few degrees of the vertical but can shift horizontally to accommodate tolerances in the spacing between connector holes.

The backup device which lies over the upper ends of the insertion pins to depress them, includes a top cover that is fixed to projections that project from opposite ends of the block, to leave a space between them, and a backup plate that lies in the space. The backup plate can be shifted from a first position wherein it depresses only some of the pins, and a second position wherein it depresses the other pins. The backup plate is provided with inclined grooves so that in the first position every other pin along a row is pressed down, while in the second position all pins are pressed down.

The lower tooling includes fixed and adjustable support parts that each supports one side of the connector housing. The adjustable part can be moved toward and away from the fixed part to support wider or narrower connectors. A spacer lies between the support parts to fix their spacing, and a screw extends between the support parts to clamp the spacer between them. The upper tooling is vertically slidable with respect to the fixed support part, to accurately position the insertion pins with respect to the connector.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded isometric view of contact insertion tooling constructed in accordance with the present invention.

FIG. **2** is an exploded isometric view of the upper insertion tool of the tooling of FIG. **1**.

FIG. **3** is a view similar to that of FIG. **2**, but showing the upper insertion tool during changeover for use from one type of connector to another type.

FIG. **4** is an end elevation view of the lower insert tool with a connector in place but showing a contact not yet inserted therein, showing the upper insertion tool in phantom lines, and showing part of a press in phantom lines.

FIG. **5** is a partial sectional view of an end portion of the upper insertion tool of FIG. **2**.

FIG. **6**A is a partial sectional view of the upper insertion tool of FIG. **2**, showing an insertion pin prior to its forceful insertion of a socket contact into a connector insulator.

FIG. **6**B is a view similar to that of FIG. **6**B, but with the socket contact fully installed.

FIG. **6**C is a view similar to that of FIG. **6**B, except that it shows a pin-contact inserted by a corresponding type of insertion pin in a corresponding connector insulator and also shows grooves in the backup plate and shows a support shim under the connector insulator.

FIG. **7** is an enlarged view showing the looseness of fit of an insertion pin in a block passage.

FIGS. **8**A–**8**D show a sampling of connector insulators of different sizes and hole arrangements, in which contacts can be inserted with the tooling of the present invention.

FIG. **9** is a plan view of the lower insertion tool, set up for a connector with three rows of contact-receiving holes.

FIG. **10** is a plan view similar to that of FIG. **9**, but set up to receive a connector with two rows of contact-receiving holes.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** illustrates contact insertion tooling **10** which includes a lower insert tool **12** that can hold a connector housing **14**, and an upper insertion tool **16** that can force electrical contacts downwardly into holes **20** in the connector housing.

As shown in FIGS. **2** and **3**, the upper insert tool **16** includes a block **22** having rows of vertically-extending pin passages **24**. A plurality of insertion pins lie in the passages, with FIG. **2** showing two types of insertion pins **30**, **32**. The first type **30** is designed for inserting contacts with upper socket ends, the pin having a narrow tip **34** at its bottom for insertion into the top of the socket contact. The second type of insertion pin **32** is tubular with an open lower end, for receiving a pin contact end, and for pressing against a shoulder at the lower end of such pin. Each insertion pin has an enlarged head **36** that rests on a block upper surface **40** that lies in a channel **41**, and has a shaft **42** that projects below the lower surface **44** of the block. The pin shafts **42** lie in loose sliding fits in the block passages. FIG. **7** shows that the pin head **36** has a downwardly-facing shoulder **45** that can abut the shoulder **40** formed by the block upper face.

A backup device **50** lies over the insertion pins, and forms a pin-pushing surface **52** that can push down the heads of the pins. The backup device actually includes a cover plate **54** with longitudinally (arrows M) opposite ends **56** that are each supported on projections **60** at the longitudinally opposite ends of the block. Fasteners **62** fix the cover plate over the block **22**, with a gap **64** (FIG. **1**) between them. The backup device **50** also includes a backup plate **70** that lies in the gap between the block and cover plate, and which can slide therein. A retainer pin **72** (FIG. **2**) projecting up from

the block, is received in a slot **76** of the backup plate, to prevent loss of the backup plate. Longitudinally opposite edges **80** of the backup plate are closely guided in lateral L movement by lying closely adjacent to vertical guide surfaces **82** of the block. The block has guide holes **84** which slidably receive guide posts **86** (FIG. **1**) projecting up from the lower insert tool, to confine the upper insert tool **16** to vertical movement on the lower insert tool.

FIG. **6**A shows a connector insulator **90** with a contact-receiving hole **20** that is designed to receive a contact **94**. The particular contact shown is a socket type, which has a hole at its upper end. Initially, the contact has been placed into the insulator hole **20** with no applied force required, the particular contact shown having barbs **96** that rest in an enlarged part **98** of the insulator hole. It requires a force of perhaps 25 pounds to fully insert the contact into the insulator, and such force is applied through the upper insertion tool **16**. After the connector insulator with loosely loaded contacts is placed in the lower insertion tool, the upper insertion tool **16** is placed on top of the lower one. Such placement is with the pin projections **34** at the lower ends of the insertion pins **30**, lying in the socket hole and with a pin lower shoulder **100** lying against the top of the contact.

As shown in FIG. **6**B, a next step is to place the insert tooling in a press **120**. A press actuator **102** presses down against the upper surface **104** of the cover plate **54**, while the lower insert tool and connector insulator **90** are supported. The downward force results in the contact at **94**A becoming fully inserted. The press actuator **102** is lifted, the upper insertion tool **16** is lifted off the lower one, and the connector including its insulator **90** is removed from the lower insertion tool.

FIG. **6**C shows the situation where the contact **110** is a type that has a pin contact portion **112** at its top. The tubular insertion pin **32** receives the pin and presses down against a shoulder **114** of the contact to push it into place. FIG. **4** shows a press **120** that includes the actuator **102** that can be moved down relative to a lower part or anvil **122**. The connector **14** is shown mounted on the lower insert tool **12**, with the upper insert tool **16** having pins **30** lying on the upper ends of the not-yet inserted contacts **94**. It is noted that the connector housing **14** has a shell **126** that surrounds the connector insulator **90**. The connector insulator **90** has opposite sides **127**, **128** that are located by vertical walls of the tracks. The first side **127** is positioned by the fixed support **212** which positions the upper tool **16** and the insertion pins **30**.

FIGS. **8**A–**8**D show a wide range of commonly available connectors, of a "rectangular type". FIG. **8**B shows a large type which is model D-50 which has three rows **131**–**133** of contact-receiving holes **20**. The particular insulator **130** has fifty holes, so it would require a force of about 1250 pounds to insert all contacts simultaneously. FIG. **8**A shows a second large type, model D-47WI whose insulator **140** has three rows of holes **20** and a large opening **142** for receiving a coaxial contact. FIG. **8**D shows a connector insulator **144** of a small type which is model E-9, that has two rows of holes **20** arranged in two rows **131**, **132**, with a total of nine holes. FIG. **8**C shows another connector insulator **146** which is model E-SW1, which has two rows of contact-receiving holes **20** and a large aperture **142**. There are many other models with different numbers of contact-receiving holes **20**. Applicant's upper insertion tool **16**, shown in FIG. **2**, has fifty pin passages **24** arranged in the same pattern as the holes in the insulator **130** of **8**B, which is the largest common type of rectangular contact.

In order to set up the upper insert tool **16** (FIG. **2**) to insert contacts in any of the rectangular connector insulators with two or three (or even one) row of holes, applicant first removes the backup device **50** from a position over the block **22**. Then, insert pins **30** or **32** of the proper type are inserted into all of the pin passages **24** that correspond to connector insulator holes where contacts are to be inserted. With an insulator mounted in a lower insertion tool, the arrangement of insertion pins can be checked by laying the block **22** with insertion pins therein on top of the connector insulator, and noticing if any of the pins are pushed upwardly. For example, if an insertion pin is used for the connector insulator **140** of FIG. **8**A but there is an insertion pin lying over the position **150**, then that insertion pin will "pop up" and this will be readily noticed. A similar occurrence would take place if, in FIG. **8**D an insertion pin were located at the position **152**. Of course, an insertion pin at such a location would seriously damage the connector insulator or the insertion pin, when perhaps one thousand pounds force was applied just to that pin.

With the pins in place, the backup plate **70** of FIG. **2** is laid on the surface **160** of the block. Then the cover plate **54** is laid over the backup plate and directly on the projection **60** of the block, and the fasteners **62** are fastened, so heads **164** of the fasteners lie below the upper surface **104** of the cover plate. The assembled upper insertion tool **16** is then placed on the lower one, with the guide holes **84** receiving the guide posts of the lower insertion tool, and the assembled insertion tooling is placed in the press and the upper insertion tool is pressed down.

The fastener heads **164** of FIG. **2** lie in fastener-receiving holes **180** formed in the cover plate **54**. Each fastener-receiving hole has an elongated through hole part **182** and a round recess part **184** that extends only partially through the cover plate, from its upper surface. Each of the fasteners **62** has a threaded lower end **186** that lies in a threaded hole **190** in the block. The heads **164** are elongated with a greater length than breadth, and when they are aligned with the through hole parts **182** the cover plate **184** can be readily removed. When the cover plate is replaced and the heads **164** are turned about 90°, the heads then prevent removal of the cover plate. FIG. **3** shows the usual positions of the fastener heads **164** when the cover plate **54** is removed. Thus, the cover plate can be readily removed, allowing the backup plate **70** to be easily lifted and the insertion pins to be arranged in a specific pattern and checked. It is noted that set screws **192** are used to resist vibration induced turning of the fastener **62**. FIG. **5** shows a fastener **62** with its head **164** lying in a recess **184** of the cover plate **54** and turned 90° to hold down the cover plate.

It would be possible to construct the backup plate **70** of FIG. **2** so its lower surface **52** would insert all insertion pins in a single operation. However, applicant provides a row of grooves **200** that allow the insertion of only every other contact along the staggered rows in a first insertion operation, and to then insert the rest of the contacts in a second operation. FIG. **8**A shows a few of the grooves **200**. It is noted that the holes **20** are staggered along each pair of adjacent rows. Applicant's grooves **200** are inclined along a line **202** from both the longitudinal and lateral directions M, L, so that each groove can receive the heads of insertion pins of each of the three rows. As a result, the grooves **200** receive alternate insertion pins along each row. As shown in FIG. **6**C, the heads **36**A of alternate insertion pins can be received in the grooves **200**, so only every other pin is pushed down by the backup device **50**. An advantage of this is that large spreading forces are applied only to every other

hole in a long row, to minimize trauma to the insulator and avoid damage to it during insertion of half of the contacts. In a second step, the backup plate **70** is shifted in a forward lateral direction F (FIG. **2**), so that there is a pushing surface portion above the heads of all pins and the other half of the pins are pushed down into the connector insulator in a second operation of the press.

The insertion pins such as **30** are loosely slidably received in the pin passages **24**. Applicant's FIG. **7** shows this situation, wherein there is a difference in diameters between the diameter A of the pin shank **42** and the diameter B of the pin passage **24** in the block **22**. The purpose of such looseness is to allow the pins **30** to shift horizontally slightly to account for the fact that the connector insulators are constructed so there is a tolerance in the precise positions of their holes. For example, in a connector such as shown in FIG. **8**B where the row-to-row distance C is 0.112 inch and the pitch E of the holes is 0.108 inch, the precise position of each hole can vary (in directions M and L) by ±3 or 4 mils (1 mil=one thousandth inch) from a theoretical position. An upper insertion tool that applicant constructed for such connectors had a block **22** with passages **24** each of a diameter B of 81 mils, with the shanks **42** of the insertion pins each having a diameter A of 73 mils (the difference is 11% of the pin diameter). This allows each pin to shift by four mils in any radial direction within its pin passage, from a center position. However, the pin passages **24** have a height H of 0.248 inch, to limit the tilt angle G of the pin, since the pin must remain substantially parallel to the connector insulator holes to prevent cocking of the contacts during insertion, such cocking possibly leading to damage. For the specifications given above, the maximum tilt angle G is about two degrees. Applicant prefers that the difference in pin and passage diameters be between 5% and 15% of the pin diameter and that the height H of the pin passage be at least twice the pin diameter A to minimize such tilt while allowing moderate horizontal pin shift.

The lower insert tool **12** shown in FIG. **1** includes a base **210**, a fixed support **212** that is fixed to the base, and an adjustable support **214** that can slide in the lateral direction L towards and away from the fixed support. This allows the precise holding of connector housings **14** of different widths (for two and three row connectors). Each connector has a plurality of holding tracks, or connector housing supports **216**, on which the connector shell **126** lies, with a vertical surface at the outer edge of each track to precisely, position the connector housing in the lateral directions L. The connector is laid on the tracks of the two connectors and slid in a longitudinal direction until it abuts an end **220** of a longitudinal adjustment screw **222**. The connector housing **14** is then precisely positioned, so when the upper insertion tool **16** is lowered with its guide holes **84** receiving the guide posts **86**, the lower ends of the insertion pins will lie properly over the contacts.

Applicant places a spacer **230** between the fixed and adjustable supports **212**, **214** to properly space them to precisely hold the connector housing **14** in position. The spacer **230** includes a first part **232** and a support shim **234**. As shown in FIG. **4**, the support shim **234** supports a middle portion of the connector insulator **90**, and two of such support shims may be used where necessary, to lie on opposite sides of the middle row **132** of insulator holes. Referring again to FIG. **1**, it can be seen that a pair of adjustment screws **240** is provided, which is threadably connected to the thick support **212** and slidably connected to the adjustable support **214**, to press the adjustable support firmly against the thick support.

Connectors with rectangular insulators are available in different pitches. For example, a common type of such connector has contacts at a pitch of two millimeters instead of 0.108 inch (2.74 mm). Although the lower insert tool **12** can be used in such case by using the proper spacer, a different upper insert tool is required because of the different spacing of the pin-receiving passages. Similar contact insertion tooling can be used for other shapes of connectors, provided that correspondingly-shaped lower and upper insert tools are provided.

Thus, the invention provides an apparatus for inserting and/or receiving electrical contacts into holes of a connector insulator, which enables the same insertion tooling to be used for a variety of types of connectors having a different number of rows of contact-receiving holes and/or a different number of contacts in each row. The insertion tooling includes a lower insert tool with holding tracks that support the connector housing, and an upper insertion tool that can slide vertically on the lower one and which has insertion pins for pressing down contacts into the connector insulator holes. The upper insertion tool includes a block with a plurality of rows of pin passages that can receive pins with lower ends that can press down a contact into place. The upper insertion tool also includes a backup device which can be pressed down by a hydraulic or manual press to push down the pins. The insertion pins lie loosely in the pin passages to allow for tolerances in the positions of the connector insulator holes, but with the passages being tall enough to avoid more than a minimum tilt of the insertion pins. The backup device includes a backup plate whose lower surface lies directly on heads of the insertion pins and a cover plate. The backup plate is slidable between first and second positions, and has grooves so in the first position only some of the pins are pushed down to insert perhaps only half of the electrical contacts, while in a second position other insertion pins are pressed down in a second insertion step to install the rest of the electrical contacts.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art, and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. Apparatus for inserting electrical contacts into holes of an insulator of a first electrical connector housing, comprising:

a lower insert tool comprising a connector housing support for supporting the connector housing;

an upper insert tool;

said upper insert tool being moveable in a vertical sliding path toward said lower insert tool;

said upper insert tool including a block having a plurality of horizontal rows of vertically-extending pin passages and a plurality of insertion pins that each has an upper end and that each projects vertically through one of said passages in a loose sliding fit therein, with each insertion pin having a pin lower end for pushing one of said contacts into one of said insulator holes, and said upper insert tool includes a backup device which lies over said insertion pins and which has a pin pushing surface for lying against said pin upper ends, with said back-up device being removable from a position over said insertion pins so selected insertion pins can be removed from selected passages and inserted into other selected passages by sliding said pins through said passages.

2. The apparatus described in claim 1 wherein:

each of said insertion pins has a shaft that projects through one of said passages, with the difference between passage and shaft diameters being between 5% and 15% of the shaft diameter, and with each passage having a length that is at least twice said shaft diameter, whereby to account for tolerances in insulator hole pitch while keeping the insertion pins aligned with the connector holes.

3. The apparatus described in claim 1 wherein:

said insertion pins have upper ends and said block has a pair of upstanding projections;

said backup device includes a backup plate which lies over said upper ends of said insertion pins;

said backup device includes a cover plate which lies above said backup plate and which lies on said upstanding projections of said block;

said backup plate has a lower surface with at least one groove that is wide enough to receive at least a first group of said insertion pin upper ends, and said backup plate is slidable horizontally between a first position wherein said groove lies over said first group of pin upper ends to receive them and a second position wherein said groove does not lie over said first group of pin upper ends but said backup plate lower surface lies over said first group of pin upper ends.

4. The apparatus described in claim 1 wherein:

said lower insert tool includes fixed and adjustable support parts that each forms one lateral side of said connector housing support, and a base;

said fixed support part is fixed to said base, and said adjustable support part is moveable laterally toward and away from said fixed support part;

a spacer for lying between said support parts to fix their spacing;

at least one screw extending between said support parts and threadably coupled to one of them, said screw being tightenable, to thereby clamp said spacer between said support parts or to clamp said support parts together.

5. The apparatus described in claim 4 including a plurality of connector housings, including said first connector housing, with said plurality of connector housings including a first type that has three rows of contact-receiving holes and a second type that has only two rows of contact-receiving holes, with a first row of both types being spaced the same distance from said first side of each connector housing, wherein:

said block has three rows of pin passages, with said insertion pins being removable from at least a third of said rows;

said lower insert tool and said upper insert tool are each constructed with a pair of vertical guide parts, including walls forming a pair of vertically extending guide holes in one of said tools and a pair of vertically projecting pins fixed to the other one of said tools wherein said pins fit into said guide holes, to accurately position said upper insert tool over said lower tool while letting said upper insert tool slide vertically;

the pair of vertical guide parts fixed to said lower insert tool are fixed to said fixed support part, whereby to accurately insert pins into both said first or second types of connectors.

6. The apparatus described in claim 1 wherein:

said electrical connector housing has opposite sides, and said electrical connector housing has an insulator with upper and lower ends and with at least two laterally-spaced rows of contact-receiving holes extending vertically through said insulator;

said lower insert tool includes first and second support parts that each forms a support track of said connector housing support, and a base, with said electrical connector housing opposite sides each supported on a different one of said support tracks;

a support shim lying between said support parts, said shim having a lower end lying on said base and an upper end lying against the bottom of said insulator lower end, between a pair of said rows of holes.

7. The apparatus described in claim 1 wherein:

said backup device has at least one fastener head-receiving hole;

a fastener having lower ends rotatably mounted about a vertical axis on said block and having an upper end with a fastener head lying in said head-receiving hole, said head having a horizontal length and having a horizontal breadth in a direction perpendicular to said length with the length being greater than the breadth;

said head-receiving hole including a recess part having a width at least as great as said head length to allow said fastener head to turn therein, and said head-receiving hole having a through hole part that can pass said fastener head at only a predetermined rotational position of said fastener head.

8. Apparatus for forcefully inserting electrical contacts into holes of an insulator of an electrical connector housing, which includes upper and lower insertion tools with said upper tool being moveable in a vertical sliding path with respect to said lower tool wherein said lower tool includes a track for supporting the connector housing, wherein:

said upper insertion tool includes a block having a plurality of rows of vertical passages, a backup device removably mounted on top of said block, and a plurality of insertion pins that each extends down through and below one of said passages in a sliding fit therein with said insertion pins being freely slidable upwardly and out of said block passages, but with said insertion pins and said block having shoulders positioned to abut one another to limit downward movement of said insertion pins;

said backup device includes a cover plate lying over and mounted to said block with a space between portions of said cover plate and said block, and said backup device includes a backup plate slidably mounted in said space to move between at least first and second positions;

said cover plate has a lower surface that lies closely over only a first group of said insert pins but not closely over a second group of said insert pins in said first position, with said lower surface lying closely over said second group of insert pins in said second position.

9. The apparatus described in claim 8 wherein:

said rows all extend in longitudinal directions and said rows are laterally spaced, with the holes in adjacent rows being staggered so a pair of pins lying in different adjacent rows lie on an imaginary inclined line that is inclined from both said lateral and longitudinal directions;

said backup plate is slidable only in said lateral direction between said first and second positions;

said lower surface of said plate has a plurality of grooves that are each wide enough to receive the upper ends of said insertion pins, with said grooves extending parallel to said imaginary inclined line.

10. The apparatus described in claim 8 wherein:

said block has a longitudinally-extending channel with said passages extending downwardly from the bottom of said channel;

said insertion pins have enlarged heads that lie in said channel.

11. The combination of an electrical connector with an insulator that has a plurality of horizontally-extending rows of insulator holes and a plurality of rows of contacts that are constructed for press fit insertion into said insulator holes, and apparatus for inserting said contacts with the use of a press or the like that includes an anvil and an actuator that can move toward and away from the anvil, comprising:

a lower insert tool for lying on said anvil, said insulator being mounted on said lower insert tool, and said plurality of contacts lie vertically aligned with said insulator holes so downward pushing of the contacts moves them into said insulator holes;

an upper insert tool which is located over said insulator to be pressed down by said actuator, with said upper insert tool being guided in downward movement toward said lower insert tool;

said upper insert tool including a block having a plurality of horizontally-extending rows of vertical pin passages, a plurality of insertion pins that each projects vertically through one of said passages in a loose sliding fit therein, with each insertion pin having a lower end lying substantially against the upper end of one of said contacts, and a backup device which lies over said insertion pins and which has a pin pushing surface for lying against said pins.

12. The combination described in claim 11 wherein:

said plurality of horizontal rows of pin passages includes more pin passages than the number of holes in said insulator, with a plurality of said passages being vertically aligned with said contacts and containing said insertion pins, and with a plurality of said passages not being aligned with said contacts and being devoid of insertion pins.

13. The combination described in claim 1 wherein:

said plurality of horizontal rows of pin passages includes more pin passages than the number of holes in said insulator, with a plurality of said passages being vertically aligned with said contacts and containing insertion pins, and with a plurality of said passages not being aligned with said holes in said insulator being devoid of insertion pins.

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